REPORT
TO
ALBARRIE CANADA

SORBWEB PLUS OIL CONTAINMENT PILOT TESTS
80 MORROW ROAD
BARRIE, ONTARIO

Prepared by:

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October 2013

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21 October 2013

Albarrie Canada
80 Morrow Road
Barrie, Ontario
L4N 3V7

Attention:  Ms. Margaret Driscoll
             Executive Director

Re:  SorbWeb Plus Oil Containment Pilot Tests

Dear Ms. Driscoll:

We are pleased to provide our report documenting our review of the installation and performance of two pilot SorbWeb Plus secondary oil containment systems. Albarrie Canada’s (Albarrie) objective for the pilot test program was to obtain verification of the hydrocarbon spill performance of the SorbWeb system for a 72-hour time period when subjected to a major transformer oil spill.

The methodology involved constructing two scaled down pilot units. The pilot units were installed according to the procedures documented in the Albarrie SorbWeb Plus General Contractors Manual. Each unit received a simulated ‘spill’ of 410 litres of transformer oil (Voltesso 35 on one and Luminol TRi on the second), and was left for 72 hours. There was no visual evidence of oil penetration through the oilmat. This was further confirmed when the test results for sand samples collected from below the oilmat and sent to an accredited commercial testing laboratory were below the laboratory reporting limits (RDL), which are below regulatory standards.

Thus the SorbWeb Plus pilot testing program demonstrated that the units successfully met Albarrie’s objective and contained the ‘spilled’ oil for a period of 72 hours.
We trust that the material presented in this report meets with your requirements. If you have any questions please do not hesitate to contact me.

Yours very truly,

DECOMMISSIONING CONSULTING SERVICES

[Signature]

John N. Hilton, M.A.Sc., P.Eng.
President
2.0 METHODOLOGY

At the Albarrie facility, bench scale testing using 10 and 15 cm diameter columns has generally been used to investigate the performance of the oilmat and adsorbent system for various transformer oils, and to assess components and design characteristics of the system such as oilmat materials, thickness, different types of oilmats, and application conditions of glues. However, Albarrie determined that an outdoor scaled down pilot system would be required to simulate the performance of the full scale installation in order to provide assurance that future installations would perform as required. Thus two pilot oil containment systems (one tested using Voltesso 35 transformer oil and the second using Luminol TRi transformer oil) were installed in excavated earthen pits on a vacant field on the Albarrie property in Barrie to carry out the tests.

The oil spill simulation was to be carried out using 2 drums of transformer oil (410 litres) per pilot bed. According to Albarrie design calculations, 410 litres of oil represents 25% of the system design capacity. The oil was limited to this volume to minimize the quantity of waste oil requiring disposal upon completion of the pilot test.

Each pilot test bed was constructed with an earthen perimeter by excavating a base representative of a field installation and installing all components of the full-scale unit – oilmat, adsorbent layer, sand layers, woven and nonwoven geotextiles, and a layer of washed crushed stone. The depths of the layers were representative of full-scale field units. All seams and joints between fabrics were sealed using the procedures\(^1\) outlined in Albarrie’s \textit{SorbWeb Plus General Contractors Manual} (Appendix E). For full scale installations, larger containment systems may require several oilmats to be joined together. A procedure was included in the pilot program to test the effectiveness of the current materials and methods used to connect two sections of oilmat. A seam was cut across the centre of the oilmat then sealed to represent two pieces of oilmat being installed in a full-scale system. The sealing procedure followed methods outlined in the Albarrie \textit{SorbWeb Plus General Contractors Manual} (Appendix E). A detailed outline of the installation procedure along with associated photographs is provided in Appendix A.

The two pilot beds were constructed 20 September, 2013 and then saturated with water until water discharge from the bottom was observed. The systems were then left undisturbed 12 to 14

\(^1\) Sikaflex caulking used for oilmat to oilmat and oilmat to liner joints is heated to about 70 to 80 degrees Celsius as noted in Step 5 of Appendix E,
hours for the sealants to set. According to Albarrie personnel, a major overnight rainstorm resulted in accumulated water in the beds the following morning. Before the oil spill simulation, this water was pumped out from the side chamber which received the discharge from the bottom of the beds.

Two drums (totalling 410 litres) of mineral oil were 'spilled' onto the stone on the top of each of the beds (Luminol TRi on one and Voltesso 35 on the second) on 21 September, and the beds were deconstructed and inspected 72 hours later on 25 September. Details of the deconstruction of the beds and inspection of the layers and associated photographs are provided in Appendix B.

Plan and Profile Drawings showing the structure and approximate dimensions of the pilot beds are provided at the end of this report.
3.0 OBSERVATIONS AND RESULTS

Albarrie’s objective for the pilot test was to obtain verification of the hydrocarbon spill performance of the SorbWeb system for a 72-hour time period when subjected to a major transformer oil spill.

During the deconstruction of both the pilot beds visual observations indicated that there were no leaks through the adsorbent mats or any seams or joints, and the oil was completely contained. As indicated in the deconstruction log (Appendix B), the adsorbent layer was saturated with blue dyed oil. In locations where the oil reached the oilmat, the copolymer had formed a congealed layer. A white fabric was used to blot the under side of both oilmats and there was no evidence of blue dye. Two samples from the sand layer below the oilmat of each pilot bed were sent to Maxxam Analytics, a Canadian Association for Laboratory Accreditation (CALA)-accredited commercial laboratory, for analysis of oil content (petroleum hydrocarbon fractions F2 through F4) to confirm these observations.

The laboratory Certificate of Analysis providing the results of the petroleum hydrocarbon testing of the sand samples collected from below the oilmats after the secondary oil containment pilot tests is provided in Appendix C. All results were below the laboratory Reportable Detection Limit (RDL) for each of the fractions tested. The table below shows the laboratory RDL in comparison with the Ontario Ministry of the Environment (MOE) Ontario Regulation (O.Reg.) 153/04 Table 1 Full Depth Background Site Condition Standard, Industrial/Commercial Property Use and Table 2 Full Depth Generic Site Condition Standards in a Potable Ground Water Condition, Industrial/Commercial Property Use.

These results confirm the visual observations that there were no leaks through the adsorbent mats or any seams or joints in either of the pilot SorbWeb units.
<table>
<thead>
<tr>
<th>PHC Fraction</th>
<th>RDL - Result* for All Samples</th>
<th>Standard** (Table 1)</th>
<th>Standard*** (Table 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1 (C10 - C16)</td>
<td>&lt;10</td>
<td>10</td>
<td>230</td>
</tr>
<tr>
<td>F2 (C16 - C34)</td>
<td>&lt;50</td>
<td>240</td>
<td>1700</td>
</tr>
<tr>
<td>F3 (C34 - C50)</td>
<td>&lt;50</td>
<td>120</td>
<td>3300</td>
</tr>
</tbody>
</table>

* Concentrations in μg/g  
** MOE O.Reg. 153/04 Table 1 Full Depth Background Site Condition Standard, Industrial/Commercial Property Use  
*** MOE O.Reg. 153-04 Table 2 Full Depth Generic Site Condition Standards in a Potable Ground Water Condition, Industrial/Commercial Property Use.
4.0 CONCLUSIONS

Albarrie's objective for the pilot test was to obtain verification of the hydrocarbon spill performance of the SorbWeb system for a 72-hour time period when subjected to a major transformer oil spill.

The results of the pilot test program demonstrate that the SorbWeb system successfully met Albarrie's objective and contained a 410 litre transformer oil 'spill' for a 72-hour time period. No oil passed through the oilmat barrier.

After observing the construction of the pilot SorbWeb Plus units it is clear that a very important factor in the installation of the oil containment system to guarantee successful performance is the proper application of caulking, glue, and adhesive tape to insure that oil cannot migrate / infiltrate through seams and joints. As part of the pilot program initiative Albarrie has prepared an Inspection and Test Plan (ITP) (Appendix D) to be completed during the installation of each SorbWeb Plus Secondary Oil Containment system. According to this procedure, all installation steps are to be signed off by the Albarrie technician and a customer representative. The ITP presented in Appendix D is oriented to the pilot unit installations and must be modified to include the design specifications for each individual installation. The rigorous monitoring of this check list will provide a high level of confidence that all components of the system have been installed and assembled correctly.